

CR programming for Bucky trays with 3-field and 5-field chambers Optimus and Velara generators

Programming film-screen data sets and their results are explained for **Optimus** first.

Optimus and the **AgentT** program provide all default value tables and the calculated tables afterwards. Such screens and the modifications can actually not be seen at **Velara** generators, but the principles and the results are identical.

The chemistry of the CR film is similar to the (wet film) screens of luminous group 6. The values in the table determine a linear S = sensitivity value for CR systems (density for wet films) between 40...150kV..

As one can see in the following data table CR speed class 400 (**x**) has a speed of only 176 at 40kV, its highest speed is 444 at 100kV.

Name	IMAGING PLATE 400
ID No.	317
Abbreviation	B400
Colour	b
S(40)	176.00
S(50)	263.00
S(60)	350.00
S(70)	400.00
S(80)	428.00
S(90)	443.00
S(100)	444.00
S(120)	422.00
S(140)	394.00
S(150)	380.00

(**x**) All non-thorax screen speed classes are specified at 70kV.

To achieve a linear S-value at CR development systems a 40kV exposure requires e.g. a

$$\frac{400}{176} = 2.3 \text{ times higher dose.}$$

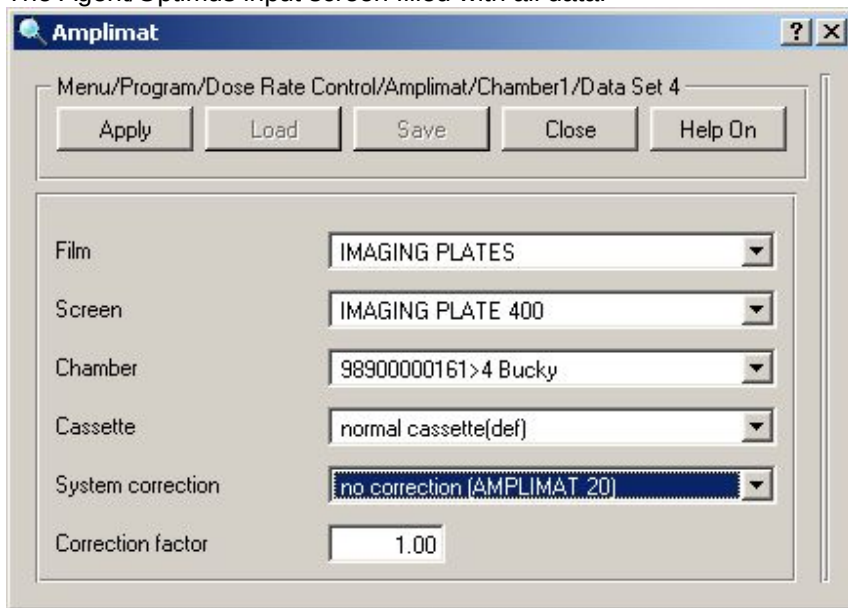
Screen data are multiplied with all other items of the default programming data for the film-screen data set (see calculation table page 4).

At the end of the calculation process one gets a table from 40...150kV which determines the exposure termination setpoint value for DRC = dose rate control.

This threshold value (U_off) is taken from the table according to the selected application / APR..

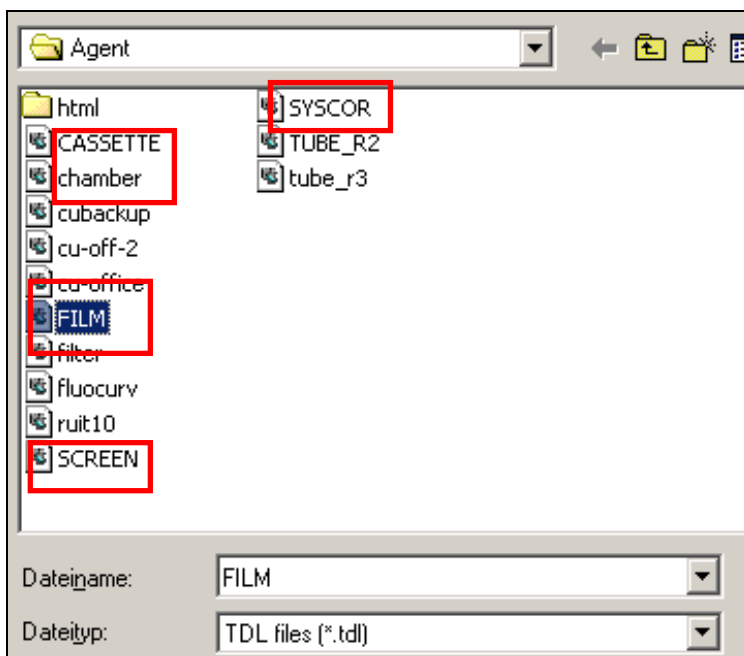
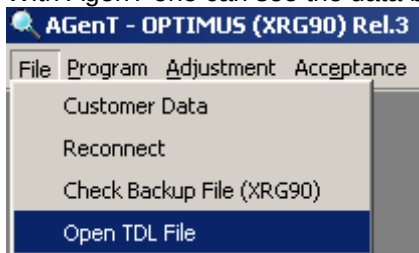
The calculation process for a 400 speed system with a 3-field Amplat chamber 9890 000 0161>4 will be explained on the following pages. For Optimus generators the calculation is carried out on the PC, then the table is sent to the generator. The Velara process is explained on page 7.

The Agent/Optimus input screen filled with all data:



The image shows the 'Amplimat' software window. At the top, the menu path 'Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 4' is displayed. Below this are five buttons: 'Apply', 'Load', 'Save', 'Close', and 'Help On'. The main area contains several dropdown menus and a text field: 'Film' is set to 'IMAGING PLATES', 'Screen' to 'IMAGING PLATE 400', 'Chamber' to '98900000161>4 Bucky', 'Cassette' to 'normal cassette(def)', 'System correction' to 'no correction (AMPLIMAT 20)', and 'Correction factor' is a text field containing '1.00'.

With Agent one can see the data belonging the selected items (also possible offline):



FILM

C:/program files/Developer/Agent/FILM.TDL

Apply (F2) Load (F3) Save (F4) Close Show As Text

Name	IMAGING PLATES	
ID No.		136
Abbreviation		
Factor		1.00
Colour	b	
RLF t_0 [ms]		0
RLF Drel_0		1.000
RLF t_1 [ms]		10
RLF Drel_1		1.000
RLF t_2 [ms]		20
RLF Drel_2		1.000
RLF t_3 [ms]		50
RLF Drel_3		1.000
RLF t_4 [ms]		100
RLF Drel_4		1.000
RLF t_5 [ms]		200
RLF Drel_5		1.000
RLF t_6 [ms]		500
RLF Drel_6		1.000
RLF t_7 [ms]		1000
RLF Drel_7		1.000
RLF t_8 [ms]		2000
RLF Drel_8		1.000
RLF t_9 [ms]		4000
RLF Drel_9		1.000

SCREEN

see table page 1

CHAMBER

Name	98900000161>4 Bucky
ID No.	61
S all Chamber [V/æGy]	0.19
Drel(40)	0.70
Drel(50)	0.84
Drel(60)	0.93
Drel(70)	1.00
Drel(80)	1.01
Drel(90)	1.00
Drel(100)	0.99
Drel(120)	0.96
Drel(140)	0.93
Drel(150)	0.89
t-Char. ID	0

CASSETTE

C:/program files/Developer/Agent/CASSETTE.TDL

Apply (F2) Load (F3) Save (F4) Close Show As Text

Name	normal cassette(def)	
ID No.		1
Factor		1.00

SYSTEM CORRECTION

C:/program files/Developer/Agent/SYSCOR.TDL

Apply (F2) Load (F3) Save (F4) Close Show As Text

Name	no correction (AMPLI
ID No.	2
Krel(40)	1.00
Krel(50)	1.00
Krel(60)	1.00
Krel(70)	1.00
Krel(80)	1.00
Krel(90)	1.00
Krel(100)	1.00
Krel(120)	1.00
Krel(140)	1.00
Krel(150)	1.00

CORRECTION FACTOR

Correction factor

The correction factor remains at **1.00** except Agent is used without hard key. Without PC hard key the factor must be used for the S-value / density alignment.

Default data are bold, calculated values *italic*.

KV	FILM	SCREEN	CHAMBER	CASSETTE	SYSTEM CORRECTION	CORRECTION FACTOR	calculated values for exposure
40	1	176	0.70	1	1	1	1.59
50		263	0.84		1		1.28
60		350	0.93		1		1.06
70		400	1.00		1		1.00
80		428	1.01		1		0.94
90		443	1.00		1		0.90
100		444	0.99		1		0.90
120		422	0.96		1		0.89
140		394	0.93		1		0.91
150		380	0.89		1		0.94
RLF [ms]							
0	1.00	no affecting factors	no affecting factors	no affecting factors	no affecting factors	no affecting factors	1.00
10	1.00						1.00
20	1.00						1.00
50	1.00						1.00
100	1.00						1.00
200	1.00						1.00
500	1.00						1.00
1000	1.00						1.00
2000	1.00						1.00
4000	1.00						1.00
1		2.5μGy	1		1	2.5 μGy	
basic dose of FSC and its possible correction factors							
0.19V/μGy or 5.24μGy/V			5.24 μGy/V				
basic chamber sensitivity							

Explanations for the **calculated values for exposure** value table previous page, example **50kV**:

$$\begin{array}{lcl} \text{speed 70kV} & \mathbf{400} & \\ \text{-----} & = & \text{-----} = 1.52 \times \mathbf{0.84} \text{ (chamber factor)} = \mathbf{1.28} \\ \text{speed 50kV} & \mathbf{263} & \end{array}$$

FILM, CASSETTE, SYSTEM CORRECTION and CORRECTION FACTOR have all factors of **1**.

RLF factors do not apply for CR films. All factors 1.00, see table **FILM** page 3.

Low kV correction is not used for CR systems. The S = sensitivity value will increase (less dose) by the reciprocal value of the following table factor and there will be a non-linear S-value from 40...150kV.

Name	low-kV-correction [d]
ID No.	1
Krel(40)	0.70
Krel(50)	0.78
Krel(60)	0.89
Krel(70)	1.00
Krel(80)	0.99
Krel(90)	0.95
Krel(100)	0.92
Krel(120)	0.94
Krel(140)	0.98
Krel(150)	1.00

S-value / density alignment

If required the **Abbreviation** name and the **Dose of FSC** value can be modified.

Abbreviation	B400
Dose Request Chamber [μGy/V]	5.24
Dose of FSC [μGy]	2.50

All other values **must not** be changed

Remark:

Abbreviation Any name up to six characters can be given. The abbreviation name should indicate the programmed speed type if different speeds shall be used with the same imaging plates.

Dose of FSC [μGy]: Use **K_s** explanation this page. The value can be adapted to the local "density taste".

All other data (**kV70-Char.** and **RLF**) **must** remain as they have been calculated during the programming and loading process to obtain the chamber type + imaging plate depending kV characteristic. RLF is constant = 1.

Formula to determine the **speed = S** of a film-screen-combination:

$$S = \frac{K_0}{K_s} = \frac{\mathbf{1000 \mu Gy}}{\mathbf{Dose of FSC [\mu Gy]}} \begin{array}{l} >> \text{use speed as} \\ >> \text{abbreviation} \\ >> \text{name} \end{array} \quad \begin{array}{l} \mathbf{!! S = speed \text{ must not } be mixed up !!} \\ \mathbf{!! with S = sensitivity CR !!} \end{array}$$

K₀ is a constant with a value of 1000 μGy.

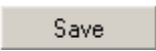
K_s is a variable value principally representing a switch off dose to obtain a density of 1.0 above base and fog, (normal films determined by the manufacturer of a film-screen system for defined processing conditions which are different in a computed RAD system). Can be adapted to the local "density taste"

If e.g. **K_s** = 2.5 μGy (like the example on pages 2...5)

$$S = \frac{1000 \mu\text{Gy}}{2.5 \mu\text{Gy}} = 400$$

Range of **speed values S** within the standard **speed class SC** systems:

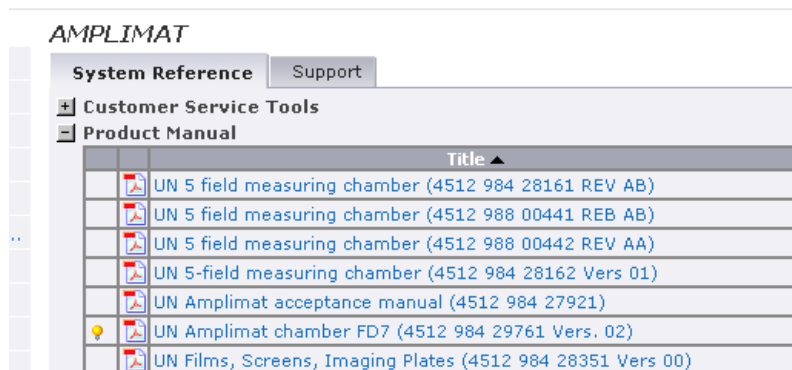
only valid for film-screen-combinations for an optical density of 1.0		
Speed class SC Standard	dose / exposure [μGy] Standard class SC	Speed value S Range
6	167	5 - 9
12	83	10 - 18
25	40	20 - 36
50	20	40 - 71
100	10	80 - 140
200	5	160 - 280
400	2.5	320 - 560
800	1.25	630 - 1100
1600	0.625	1250 - 2200

If different speeds shall be used copy one screen with  and  it to any other data set of the same or another chamber.

Change **Abbreviation** names and **Dose of FSC** values accordingly afterwards

More information available in booklet "Radiographic screens and films", manual order No. 4512 984 28351 or from the InCenter:

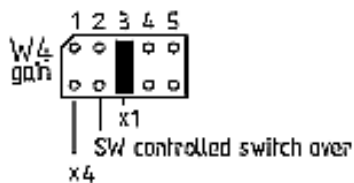
[X-Ray Generators](#)



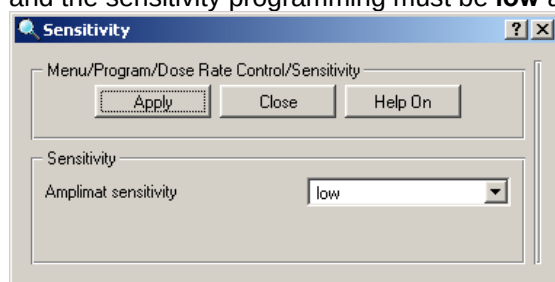
Remarks for the 5-field chamber in combination with Optimus:

The new 5-field Bucky chamber **9890 000 7000>1 Bucky** is very sensitive.

The gain jumper EZ150 W4 **must** be set in position 3 = gain **factor x1**



and the sensitivity programming must be **low** as well:



Velara programming of FSC data sets:

The input screen of Velara does not have a correction factor like Optimus.

The screenshot shows two tabs: 'Tube Config Data' and 'Film/Screen and Amplimat Config Data'. The 'Film/Screen and Amplimat Config Data' tab is active, showing a sub-tab for 'FSC 1' through 'FSC 5'. Below this, there is a 'Film/Screen config data' section with three dropdown menus: 'Film type', 'Screen type', and 'Cassette type'. Below that is a 'Chamber 1' through 'Chamber 4' section with a 'Chamber type' dropdown menu.

Once data have been entered and applied the alignment of the S-value or density take place via the following screen:

The screenshot shows the 'Correction' screen with two main sections: 'Film/Screen configuration' and 'Chamber'. The 'Film/Screen configuration' section has a table with 7 columns: 'No.', 'Film', 'Screen', 'Cassette', 'request.', 'meas.', and 'Value [%]'. There are 5 rows for 'No.' 1 through 5. The 'Chamber' section has a table with 5 columns: 'No.', 'Chamber', 'requested', 'measured', and 'Value [%]'. There are 4 rows for 'No.' 1 through 4. A 'Scale Factors' button is located to the right of the 'Chamber' table.

No.	Film	Screen	Cassette	request.	meas.	Value [%]
1						
2						
3						
4						
5						

No.	Chamber	requested	measured	Value [%]
1				
2				
3				
4				

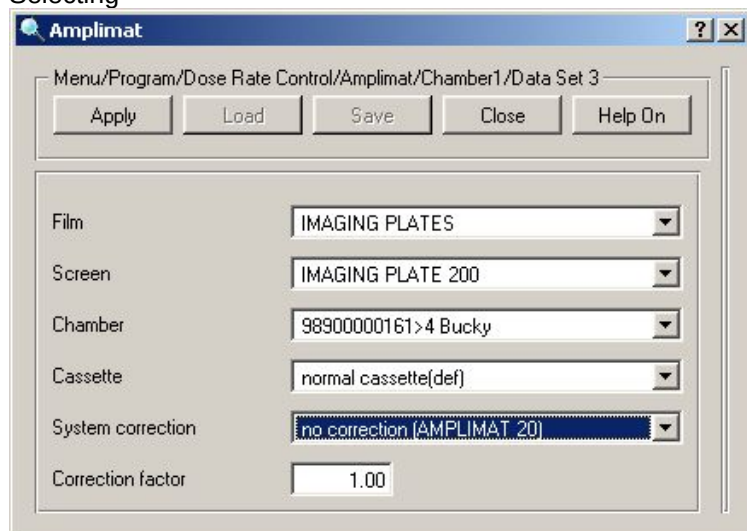
The  of both screens explains the process if the PC is online with the generator.

Velara R/F generators don't have a calculation table like Optimus which gets the data from external data files during the programming process.

All required data tables are embedded in the basic Velara R/F firmware. Once there is a request for an AEC exposure the threshold value U_{off} for the exposure termination is calculated from the default data.

3 field measuring chambers 9890 000 0161>4 Bucky

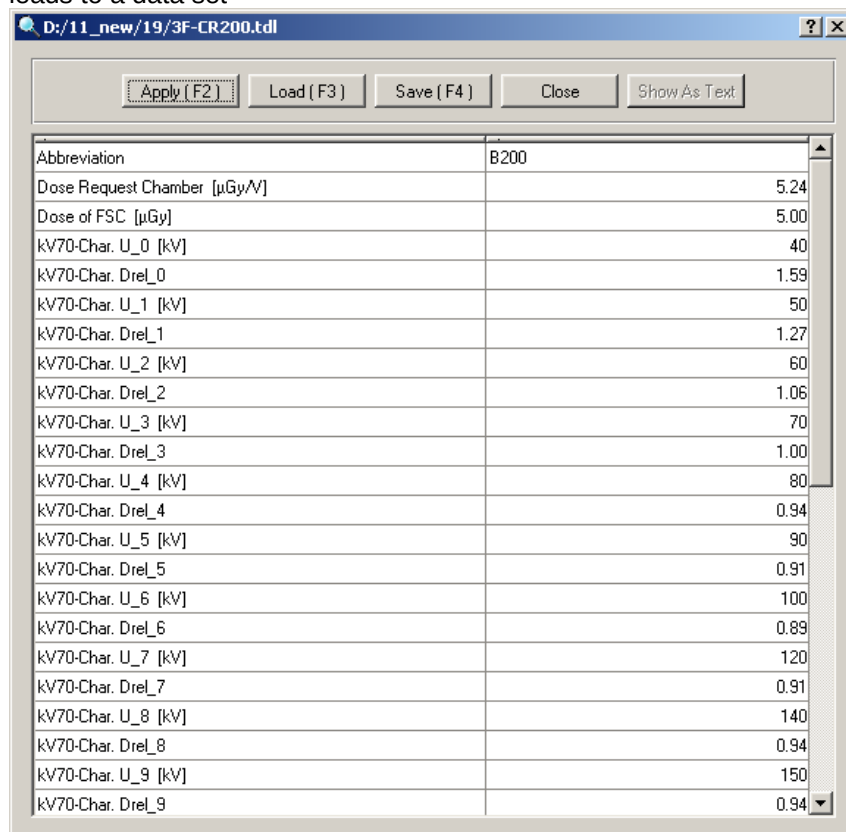
Selecting



The 'Amplimat' window displays the following settings:

- Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 3
- Buttons: Apply, Load, Save, Close, Help On
- Film: IMAGING PLATES
- Screen: IMAGING PLATE 200
- Chamber: 98900000161>4 Bucky
- Cassette: normal cassette(def)
- System correction: no correction (AMPLIMAT 20)
- Correction factor: 1.00

leads to a data set



The window title is 'D:/11_new/19/3F-CR200.tdl'. The table below lists parameters for 'B200'.

Parameter	Value
Abbreviation	B200
Dose Request Chamber [μGy/V]	5.24
Dose of FSC [μGy]	5.00
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.59
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.27
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.06
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.94
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.91
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.91
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.94
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.94

and corresponding DRC data, especially the exposure termination threshold value U_{off} (here at 70kV)

```
AEC Calculation
Mo 10. Jul 11:53:16 2006

U nominal      : 70 kV
I nominal      : 714.285 mA
t backup       : 240 ms
C eff ht      : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 3
dose nominal   : 1.00
dose calculated : 391
kV factor      : 1
U off          : 0.954 U
t corrected    : 239.884 ms
t lead AEC     : 0.216 ms
```

On the following pages you find the programming + characteristic + DRC details screens for 400 and 800 speed CR in combination with the 3-field Bucky chamber 9890 000 0161>4:

Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 4

Apply Load Save Close Help On

Film: IMAGING PLATES

Screen: IMAGING PLATE 400

Chamber: 98900000161>4 Bucky

Cassette: normal cassette(def)

System correction: no correction (AMPLIMAT 20)

Correction factor: 1.00

D:\11_new\19\3F-CR400.tdl

Apply (F2) Load (F3) Save (F4) Close Show As Text

Abbreviation	B400
Dose Request Chamber [μGy/V]	5.24
Dose of FSC [μGy]	2.50
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.59
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.28
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.06
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.94
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.90
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.91
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.94
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.94

```

AEC Calculation
Mo 10. Jul 11:53:38 2006

U nominal      : 70 kV
I nominal      : 714.285 mA
t backup       : 240 ms
C eff ht       : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 4
dose nominal    : 1.00
dose calculated : 1.95
kV factor       : 1
U off          : 0.477 U
t corrected     : 239.884 ms
t lead AEC      : 0.216 ms
  
```

Amplimat ? X

Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 5

Apply Load Save Close Help On

Film IMAGING PLATES

Screen IMAGING PLATE 800

Chamber 98900000161>4 Bucky

Cassette normal cassette(def)

System correction no correction (AMPLIMAT 20)

Correction factor 1.00

D:/11_new/19/3F-CR800.tdl ? X

Apply (F2) Load (F3) Save (F4) Close Show As Text

Abbreviation	B800	
Dose Request Chamber [μGy/V]		5.24
Dose of FSC [μGy]		1.25
kV70-Char. U_0 [kV]		40
kV70-Char. Drel_0		1.59
kV70-Char. U_1 [kV]		50
kV70-Char. Drel_1		1.28
kV70-Char. U_2 [kV]		60
kV70-Char. Drel_2		1.06
kV70-Char. U_3 [kV]		70
kV70-Char. Drel_3		1.00
kV70-Char. U_4 [kV]		80
kV70-Char. Drel_4		0.95
kV70-Char. U_5 [kV]		90
kV70-Char. Drel_5		0.90
kV70-Char. U_6 [kV]		100
kV70-Char. Drel_6		0.89
kV70-Char. U_7 [kV]		120
kV70-Char. Drel_7		0.91
kV70-Char. U_8 [kV]		140
kV70-Char. Drel_8		0.95
kV70-Char. U_9 [kV]		150
kV70-Char. Drel_9		0.94

```

AEC Calculation
Mo 10. Jul 11:54:08 2006

U nominal      : 70 kV
I nominal      : 714.285 mA
t backup       : 240 ms
C eff ht      : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 5
dose nominal   : 1.00
dose calculated : 97
kV factor      : 1
U off         : 0.238 U
t corrected    : 239.884 ms
t lead AEC     : 0.216 ms

```

5 field measuring chambers 9890 000 7000>1 Bucky

On the following pages you find the programming + characteristic + DRC details screens for 200, 400 and 800 speed CR in combination with the 5-field Bucky chamber 9890 000 7000>1:

The Amplimat window displays the following settings:

- Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 3
- Buttons: Apply, Load, Save, Close, Help On
- Film: IMAGING PLATES
- Screen: IMAGING PLATE 200
- Chamber: 98900007000>1 Bucky 5 Field
- Cassette: normal cassette(def)
- System correction: no correction (AMPLIMAT 20)
- Correction factor: 1.00

D:/11_new/19/SF-CR200.tdl	
Buttons: Apply (F2), Load (F3), Save (F4), Close, Show As Text	
Abbreviation	B200
Dose Request Chamber [μGy/V]	2.17
Dose of FSC [μGy]	5.00
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

```
AEC Calculation
Mo 10. Jul 11:46:17 2006

U nominal      : 70 kV
I nominal      : 714.285 mA
t backup       : 240 ms
C eff ht       : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 3
dose nominal    : 1.00
dose calculated : 0.943
kV factor       : 1
U off          : 2.304 V
t corrected     : 239.884 ms
t lead AEC      : 0.216 ms
```

Amplimat

Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 4

Apply Load Save Close Help On

Film IMAGING PLATES

Screen IMAGING PLATE 400

Chamber 98900007000>1 Bucky 5 Field

Cassette normal cassette(def)

System correction no correction (AMPLIMAT 20)

Correction factor 1.00

D:/11_new/19/5F-CR400.tdl

Apply (F2) Load (F3) Save (F4) Close Show As Text

Abbreviation	B400
Dose Request Chamber [μGy/V]	2.17
Dose of FSC [μGy]	2.50
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

AEC Calculation
Mo 10. Jul 11:47:04 2006

U nominal : 70 kV
I nominal : 714.285 mA
t backup : 240 ms
C eff ht : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 4
dose nominal : 1.00
dose calculated : 472
kV factor : 1
U off : 1.152 U
t corrected : 239.884 ms
t lead AEC : 0.216 ms

Amplimat

Menu/Program/Dose Rate Control/Amplimat/Chamber1/Data Set 5

Apply Load Save Close Help On

Film IMAGING PLATES

Screen IMAGING PLATE 800

Chamber 98900007000>1 Bucky 5 Field

Cassette normal cassette(def)

System correction no correction (AMPLIMAT 20)

Correction factor 1.00

D:/11_new/19/5F-CR800.tdl

Apply (F2) Load (F3) Save (F4) Close Show As Text

Abbreviation	B800
Dose Request Chamber [μGy/V]	2.17
Dose of FSC [μGy]	1.25
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

AEC Calculation
Mo 10. Jul 11:48:02 2006

U nominal : 70 kV
I nominal : 714.285 mA
t backup : 240 ms
C eff ht : 4.750 nF
selected sensor : Amplimat
dose measurement input: EZX21
film screen comb. : 5
dose nominal : 1.00
dose calculated : 236
kV factor : 1
U off : 0.576 U
t corrected : 239.884 ms
t lead AEC : 0.216 ms